

ANNUAL REPORT 1964

SAULT STE. MARIE

water pollution control plant

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SEP 13 1965

ONTARIO WATER
RESOURCES COMMISSION

DIVISION OF PLANT OPERATIONS

Ontario Water Resources Commission

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ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE GENERAL MANAGER

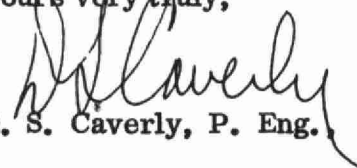
Members of the Sault Ste. Marie Local Advisory Committee,
City of Sault Ste. Marie.

Gentlemen:

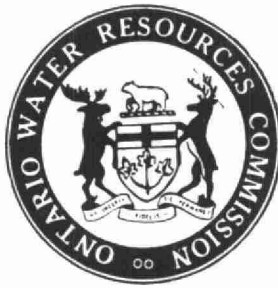
We are pleased to provide you with the 1964 Operating Report for
the Sault Ste. Marie Water Pollution Control Plant, OWRC Project
No. 58-S-20.

By continuing the mutual cooperation which has existed in the past,
we can look forward to greater progress in the field of water
pollution control.

Yours very truly,


D. S. Caverly, P. Eng.

General Manager



General Manager,
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Sault Ste. Marie Water Pollution Control Plant, OWRC Project No. 58-S-20 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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SAULT STE. MARIE
water pollution control plant
operated for

THE CITY OF SAULT STE. MARIE

by the

ONTARIO WATER RESOURCES COMMISSION

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DIVISION OF PLANT OPERATIONS

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Assistant Director: C. W. Perry

Regional Supervisor: D. A. McTavish

Operations Engineer: M. B. Fielding

801 Bay Street

Toronto 5

'64 REVIEW

The flow to the Sault Ste. Marie Water Pollution Control Plant during 1964 averaged 6.5 mgd (million gallons per day) as compared to 4.65 mgd in 1963. The flow exceeded the design plant flow of 8.0 mgd approximately 22% of the time as compared to approximately 5% of the time in 1963.

The strength of the influent sewage during 1964 was 91 ppm BOD and 144 ppm suspended solids content. The suspended solids content is considered consistent with average domestic sewage characteristics while the BOD is below average. The removal of BOD and suspended solids content was 43.0% and 70.0% respectively and is considered very good for a primary treatment plant.

The cost of operation during 1964 was \$112,623.50 representing a per capita cost of \$1.62, or a cost of \$46.29 per million gallons of sewage treated. This compares favourably with the costs incurred at other such plants in the province.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY

1952 - 1964

In 1952, the City of Sault Ste. Marie and the Townships of Korah and Tarentorus jointly decided to select a consultant to submit a report dealing with an interceptor sewer system, which would collect sewage from all three municipalities and dispose of it at a central location.

This original report on the Integrated Sewage Works was submitted in November 1953 by Proctor and Redfern, Consulting Engineers. The recommendations contained were adopted by the municipalities and they proceeded with the first stage of the four stage program. This first stage, consisting of a sanitary interceptor running east from Goulais Avenue to John Street, was completed in 1955 at a cost of approximately \$437,000.

By the spring of 1958, the three municipalities had completed negotiations with the OWRC for the three remaining stages of the integrated system. The Ontario Municipal Board gave its conditional approval in June 1958.

Tenders were called on the second stage of construction in November 1958. This stage included all sewers and force mains between John Street and the site of the present sewage treatment plant. Previously tenders had been called on part of this stage, the section between John Street and Pim Street. However, due to the lack of contractor interest and high unit prices, it was decided to re-tender, this time including all the proposed trunk sewers and force mains under one specification in two parts, Contracts A and B. Keystone Construction Ltd. of Windsor was awarded Contract A at \$709,925.51, and Beaver Construction Company Limited of Montreal was awarded Contract B at \$652,249.00. These were the lowest of a total of seven bidders.

Both of the second stage contracts were completed in March 1961 at a total cost of \$1,301,117.51, not including engineering fees, etc.

Tenders were received on May 20, 1960 for both the third and fourth stages of the integrated system.

The third stage was divided into two contracts, C and D. Contract C was for the construction of the Pim Street Pumping Station and Contract D was for the construction of the Clark Creek Pumping Station. L. R. Brown Company Ltd. of Sault Ste. Marie, which was the lowest of five bidders, was awarded both contracts at \$468,534.00. This stage was completed in October 1961 at a cost of \$459,691.42. In addition, approximately \$67,707.00 was spent on equipment and \$34,856.00 for engineering fees, etc.

The fourth stage, which consisted of the primary treatment plant and the outfall sewer, was awarded to Matthews Concrete Limited of London at \$825,873.00, the lowest of seven bids. This contract was completed on February 8, 1962 at a cost of \$801,334.74. The additional costs of this stage include an equipment cost of approximately \$240,294.00 and \$76,756.00 for engineering fees, etc.

The integrated system commenced operation as a complete unit on February 9, 1962 and was officially opened on June 6, 1962 by Mr. A. M. Snider, Chairman of the OWRC, Mayor J. L. McIntyre of Sault Ste. Marie, Reeve D. W. Murray of Tarentorus Township and Reeve J. A. Allen of Korah Township.

Project Staff



Mr. George Buckley
Superintendent

Plant Mechanic	-	Mr. J. Horsburg
Filter Operator	-	Mr. C. W. Hayes
Shift Operators	-	Mr. R. Burns
	-	Mr. J. Dobson
	-	Mr. H. Foster
	-	Mr. R. Nicholson
	-	Mr. R. McKenley
	-	Mr. H. Blume
Groundskeeper	-	Mr. J. Bray

The sewage treatment plant, supervised for 16 hours per day, is well maintained and kept in good condition both as to appearance and mechanical elements. Mr. Buckley and his staff are to be commended for their efforts.



Description of Project

INFLUENT WORKS

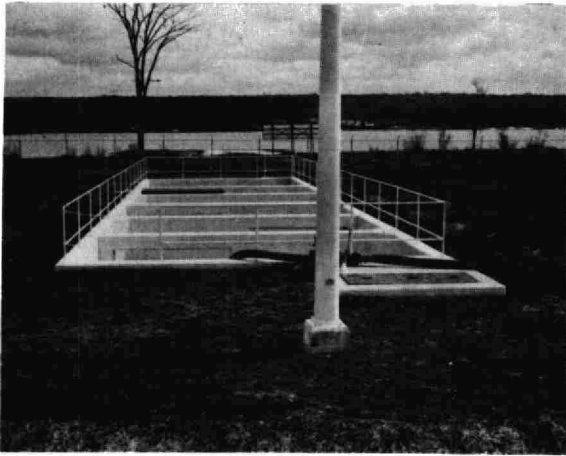
Influent to the plant is metered in a Parshall flume before undergoing any treatment. At times when the flow exceeds the capacities of the treatment units, the excess can be by-passed over a fixed weir. This by-pass flow is coarse screened to remove large solids.

The first processes in the treatment process take place in the detritor building where the flow passes through one of two barminutors and thence through one of two detritors. The barminutors collect and cut up the larger particles then return the shreddings to the flow. The detritors reduce the velocity of the flow allowing grit, sand, gravel and silty material to settle out. A revolving collector mechanism at the bottom of the detritor draws the settled material to a

sump from which a reciprocating rake lifts the material to a gantry bucket for disposal. The rake channel is equipped with two organic return pumps which return the suspended organic material back to the flow.

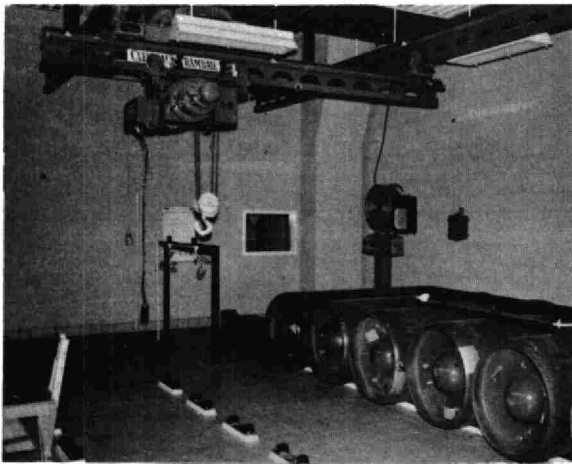
PRIMARY SEDIMENTATION TANK

From the detritor the flow is discharged via a distribution chamber to the four primary sedimentation tanks. Here the flow is detained to allow the heavier solids to settle to the bottom of the tank. The settled solids, or sludge, is removed by revolving mechanical scrapers and is pumped to a holding tank for further processing. The scum which collects on the surface of the settling tanks is removed by skimmer mechanisms and after dewatering is also pumped to the sludge holding tanks.



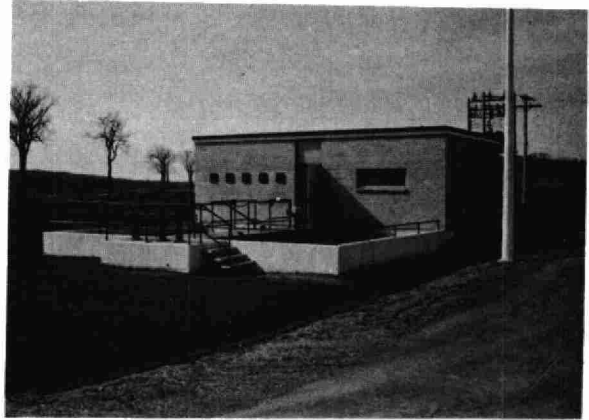
CHLORINE CONTACT CHAMBER

The effluent from the primary tanks flows by gravity to the chlorine contact chamber. Chlorine is added at this point and following a short detention period in the chamber, the effluent is discharged via a 54" outfall sewer to the St. Marys River. All by-pass flow passes through the chlorine contact chamber and is usually subjected to an increased chlorine dosage.



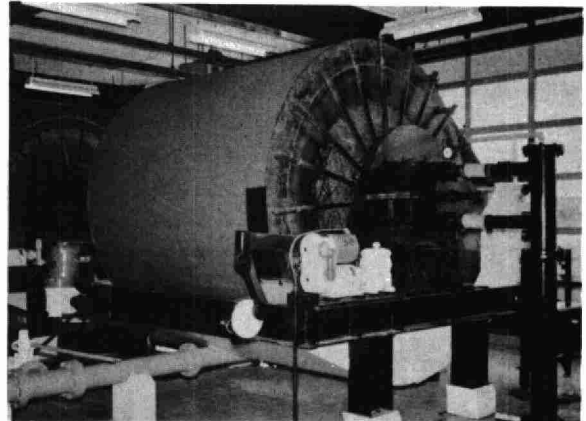
VACUUM FILTRATION

The raw sludge collected by the primary settling tanks is dewatered by one of two vacuum filters. To operate these units efficiently, they must have a sufficient



supply of sludge to run continuously for several hours. Since it is not practical to allow enough sludge to build up in the primary tanks to permit this continuous operation, sludge holding tanks have been employed to retain sludge. These holding tanks are aerated to prevent the raw sludge from becoming septic during its detention period prior to filtration.

Immediately before filtering, the raw sludge is pre-conditioned with coagulants, lime and ferric chloride, which assist in compacting the sludge on the filter surface. The dewatered sludge or filter cake is discharged to a conveyor which transports it to a skiphoist. The skip raises the filter cake to a hopper for storage until it can be hauled by truck to a disposal site.



PROJECT COSTS

<u>LONG TERM DEBT:</u>	\$1,095,614.00
(Total Capital Cost)	

The total cost to the municipality during 1964 was as follows:

Net Operating	\$ 112,623.50
Debt Retirement	22,080.00
Reserve	23,983.00
Interest Charged	60,682.38
TOTAL	\$ 219,368.88

RESERVE ACCOUNT

Balance at January 1, 1964	\$ 41,520.05
Deposited by municipality	23,983.00
Interest Earned	2,785.71
	\$ 68,288.76
<u>Less</u> Expenditures	392.02
Balance at December 1, 1964	\$ 67,896.74

<u>DEBT OUTSTANDING</u>	\$1,022,605.87
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MONTHLY COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDRY	WATER
JAN	8940.42	3730.50		125.23	2029.43	851.78	102.86	4.64	78.09	1991.21	26.68
FEB	9177.53	3730.50		489.75	760.21	1145.24	208.61		1683.30	1010.92	149.00
MARCH	4331.42	3866.79		244.80	1097.14	(2948.08)	152.86		187.44	1586.13	162.34
APRIL	9792.91	3777.50		699.21	2036.73	1917.80	168.58	13.23	275.32	766.50	138.04
MAY	14715.15	5514.74		376.32	1104.50	5607.05	218.14	396.19	242.55	1058.82	196.84
JUNE	9449.82	4567.97		192.78	1970.29	(208.81)	283.84	49.20	325.39	2046.06	223.10
JULY	6605.03	3215.92	437.64		840.35	666.34	92.38		78.38	1083.88	190.14
AUG	8960.84	3296.40	508.75		1590.84	1412.98	196.74	8.36	719.29	974.84	252.64
SEPT	8566.87	3939.04	38.01		817.52	2674.52	106.91	92.85	479.63	184.59	242.80
OCT	9812.48	3930.04		91.80	1565.26		244.86	63.04	310.44	3397.24	209.80
NOV	13009.84	3930.04			1939.66	901.58	392.41	496.15	226.33	4927.33	196.34
DEC	9261.19	6024.73		325.31	803.60	CR. 189.21	304.31	124.74	440.82	1162.19	261.70
TOTAL	112623.50	49515.17	984.40	2545.20	16555.53	11831.19	2472.50	1251.40	5046.98	20171.71	2249.42

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE \$9525.50
BRACKETS INDICATE CREDIT

YEARLY COSTS

YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1962 **	1601.26	96,491.83	+ 6.28	57.30	11 CENTS
1963	1764.94	107,538.08	6.75	61.00	10 CENTS
1964	2432.62	112,623.50	6.32	46.29	12 CENTS

** PLANT STARTED IN FEBRUARY 1962

+ BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

VACUUM FILTER COSTS

MONTH	COST PER MONTH					ACCUMU- LATIVE TOTAL	COST PER TON DRY WEIGHT					ACCUMU- LATIVE TOTAL
	FeCl ₃	LIME	LABOUR	ELEC	MAINT		FeCl ₃	LIME	LABOUR	ELEC	MAINT	
JANUARY	\$633.01	\$297.50	\$400.00	\$8.00	\$5.00	\$1343.51	\$2.13	\$1.00	\$2.69	\$0.05	\$0.03	\$5.90
FEBRUARY	392.45	178.06	400.00	8.10	25.60	1004.21	2.31	1.05	4.71	0.10	0.30	8.47
MARCH	488.22	207.81	400.00	10.45	5.00	1111.48	1.67	0.71	2.73	0.07	0.03	5.21
APRIL	419.34	173.25	400.00	10.30	5.00	1007.89	1.47	0.61	2.80	0.07	0.04	4.99
MAY	387.36	136.94	400.00	7.50	5.00	936.80	1.36	0.48	2.81	0.05	0.04	4.74
JUNE	392.95	160.12	415.00	7.70	5.00	980.77	1.17	0.48	2.47	0.05	0.03	4.20
JULY	347.61	218.75	415.00	8.90	5.00	995.26	1.00	0.63	2.39	0.05	0.03	4.10
AUGUST	265.11	212.19	415.00	7.85	93.58	993.73	0.69	0.55	2.16	0.04	0.49	3.93
SEPTEMBER	234.88	169.75	415.00	7.05	5.00	831.68	0.67	0.48	2.37	0.04	0.03	3.53
OCTOBER	244.24	183.31	415.00	8.00	5.00	855.55	0.76	0.57	2.59	0.05	0.03	4.00
NOVEMBER	232.63	168.00	415.00	7.90	5.00	828.53	0.70	0.51	2.50	0.05	0.03	3.79
DECEMBER	236.97	206.06	415.00	8.30	5.00	871.33	0.72	0.63	2.53	0.05	0.03	3.96
TOTAL	4274.77	2311.74	4905.00	100.05	189.18	11760.74						
AVERAGE PER MONTH	356.23	192.64	408.75	8.34	14.10	980.06	1.22	1.64	2.73	0.06	0.09	4.74

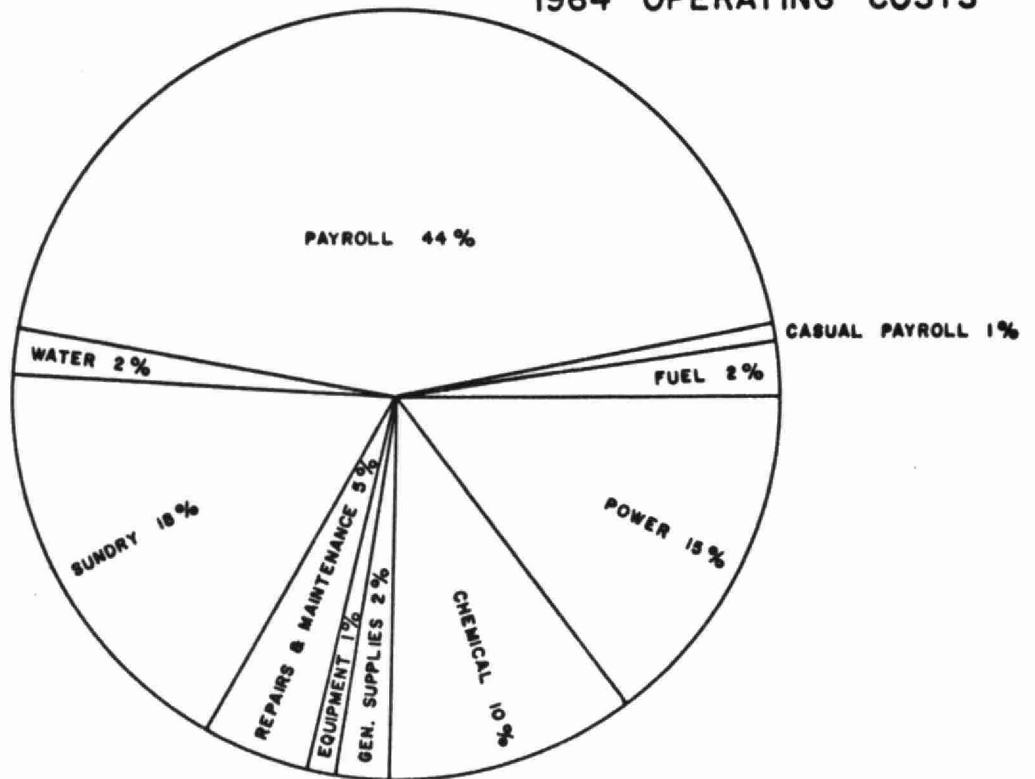
* Estimated

** \$5.00 per month estimated for lubricants, etc.

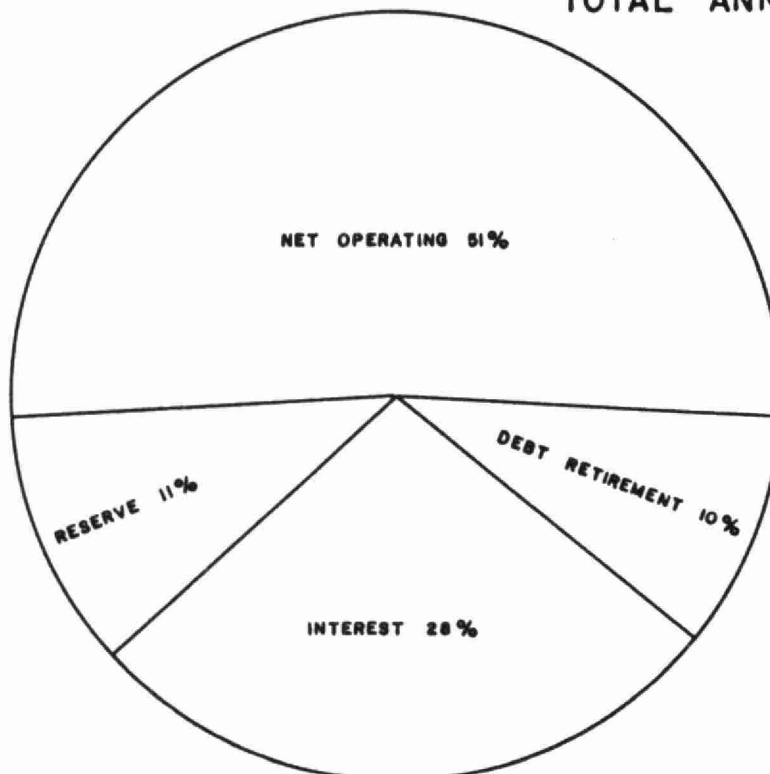
COMMENTS

The average cost of filtering sludge for 1964 was \$4.74 per ton dry weight, including chemicals, labour, power, maintenance and repair of the filters as compared to \$8.23 per ton dry weight in 1963.

1964 OPERATING COSTS

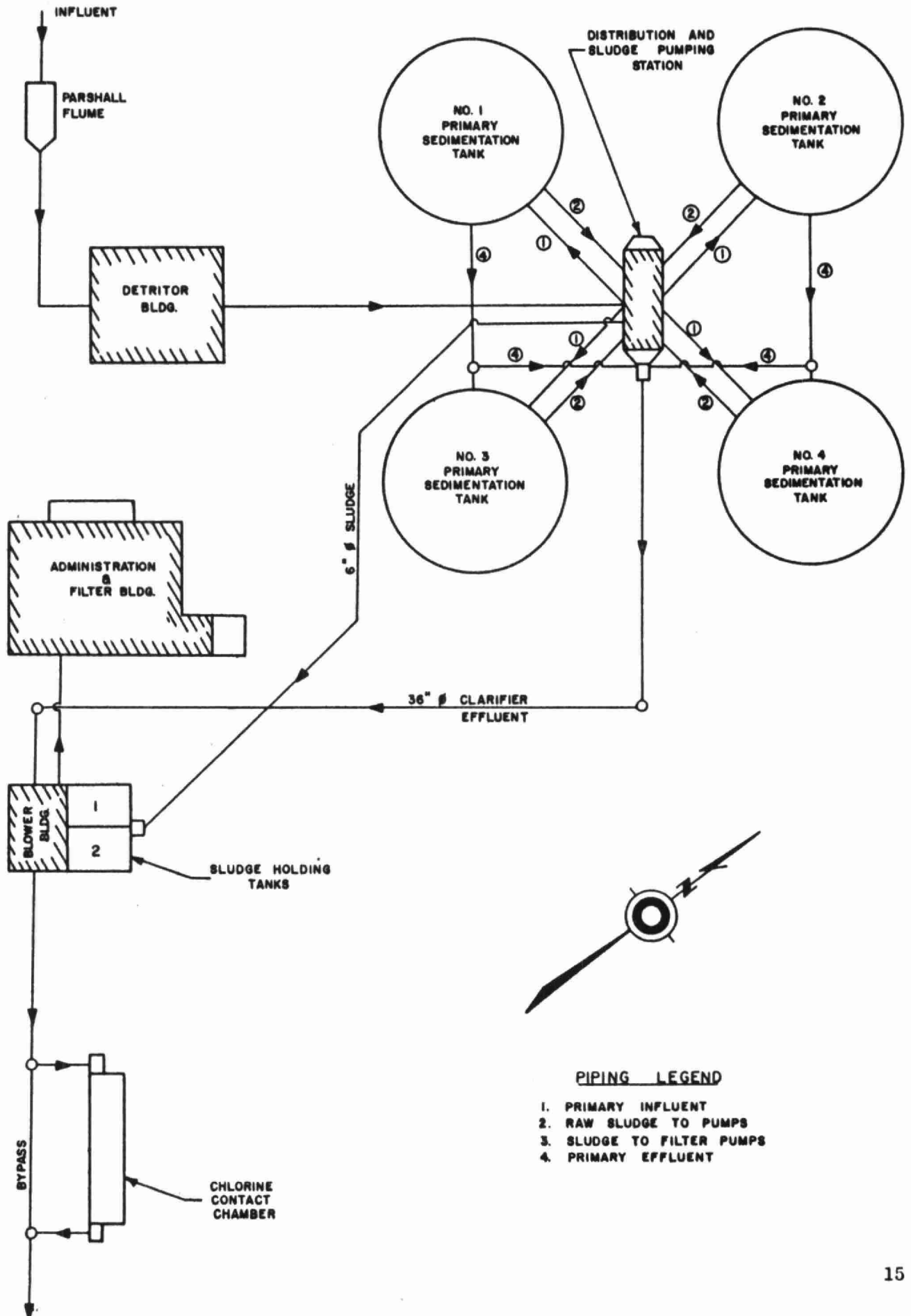


TOTAL ANNUAL COST



**Technical
Section**

SAULT STE. MARIE WATER POLLUTION CONTROL PLANT FLOW DIAGRAM



PIPING LEGEND

- 1. PRIMARY INFLUENT
- 2. RAW SLUDGE TO PUMPS
- 3. SLUDGE TO FILTER PUMPS
- 4. PRIMARY EFFLUENT

Design--Data

GENERAL

Type of Plant - Primary treatment.

Design Population - 72,500 persons.

Design Plant Flow - 8 million gallons per day.

Per Capita Flow - 110 Imperial gallons per day.

Five Day BOD -

Raw Sewage - 250 PPM

Removal - 35%

Suspended Solids -

Raw Sewage - 200 PPM

Removal - 60%

Pim Street Pumping Station

Pumps -

One Worthington 10,000 GPM at 50 ft. TDH driven by a 165 HP Dorman diesel engine.

Two Worthington each 6,300 GPM at 40 ft. TDH driven by a Brooks 75 HP electric motor.

Control -

A General Services Company Flomatcher variable speed controller coupled to a bubbler system.

Clark Creek Pumping Station

Pumps -

One Worthington 15,400 GPM at 40 ft. TDH driven by a 217 HP Dorman diesel engine.

Two Worthington each 8,400 GPM at 28 ft. TDH driven by a Brooks 75 HP electric motor.

Control -

A General Services Company Flomatcher variable speed controller coupled to a bubbler system.

PRIMARY TREATMENT PLANT

Influent Sewer

Thirty-six inch diameter force main.

Metering

Parshall flume - length 14 ft. 11 in., throat 4 ft.

Screening

Two Chicago Pump Company 36 inch Model C barminutors.

Coarse bar screen in each by-pass channel.

Grit Removal

Two Dorr-Oliver-Long 18 ft. diameter detritors complete with collecting mechanisms.

Grit Removal - Continued

Volume - 6,240 Imperial gallons.

Detention time - 1.13 minutes.

Velocity - 0.209 feet per second.

Primary Sedimentation Tanks

Four Dorr-Oliver-Long 70 ft. diameter "Squarex" clarifiers complete with scum and sludge removal mechanisms.

Volume of each - 36,000 cubic feet or 225,000 Imperial gallons.

Detention time - 2.3 hours at 8 ft. depth.

Surface Settling Rate - 520 Imperial gallons per sq. ft. per day.

Weir Overflow Rate - 13,000 Imperial gallons per lineal foot per day.

Chlorine Contact Chamber

One Wallace and Tiernan V-notch gas chlorinator. Maximum dosage of 800 lbs. per day.

A Cleveland Tramrail Hoist is used to handle the one-ton chlorine cylinders.

A Fairbanks-Morse 9,000 pound scale is used to weigh the one ton cylinders.

Aerated Sludge Holding Tank

Two rectangular tanks 24' x 15' x 11.5'.

Volume of each tank - 4,140 cubic feet or 25,800 gallons.

One Sutorbilt 8 HVB blower, driven by a 2.5 HP General Electric induction motor.

Raw Sludge Vacuum Filtration

Two Komline-Sanderson filters, each complete with conditioning tanks and agitators and driven by a Reeves Varispeed motor.

One Crofts-Bradford gear driven conveyor powered by a Brooks 2 HP electric motor.

One Webster-Smallwood skip hoist powered by a BEPCO 5 HP motor.

Pumps

Four Marlow Plunger Type raw sludge pumps each powered by a 2 HP Leland-Newman motor.

Two Komline-Sanderson Plunger Type sludge pumps rated at 60 GPM and each powered by a 1 1/2 HP C. G. E. induction motor.

Two Komline-Sanderson diaphragm type lime pumps rated at 20 GPM and each powered by a 1/4 HP Reeves motor.

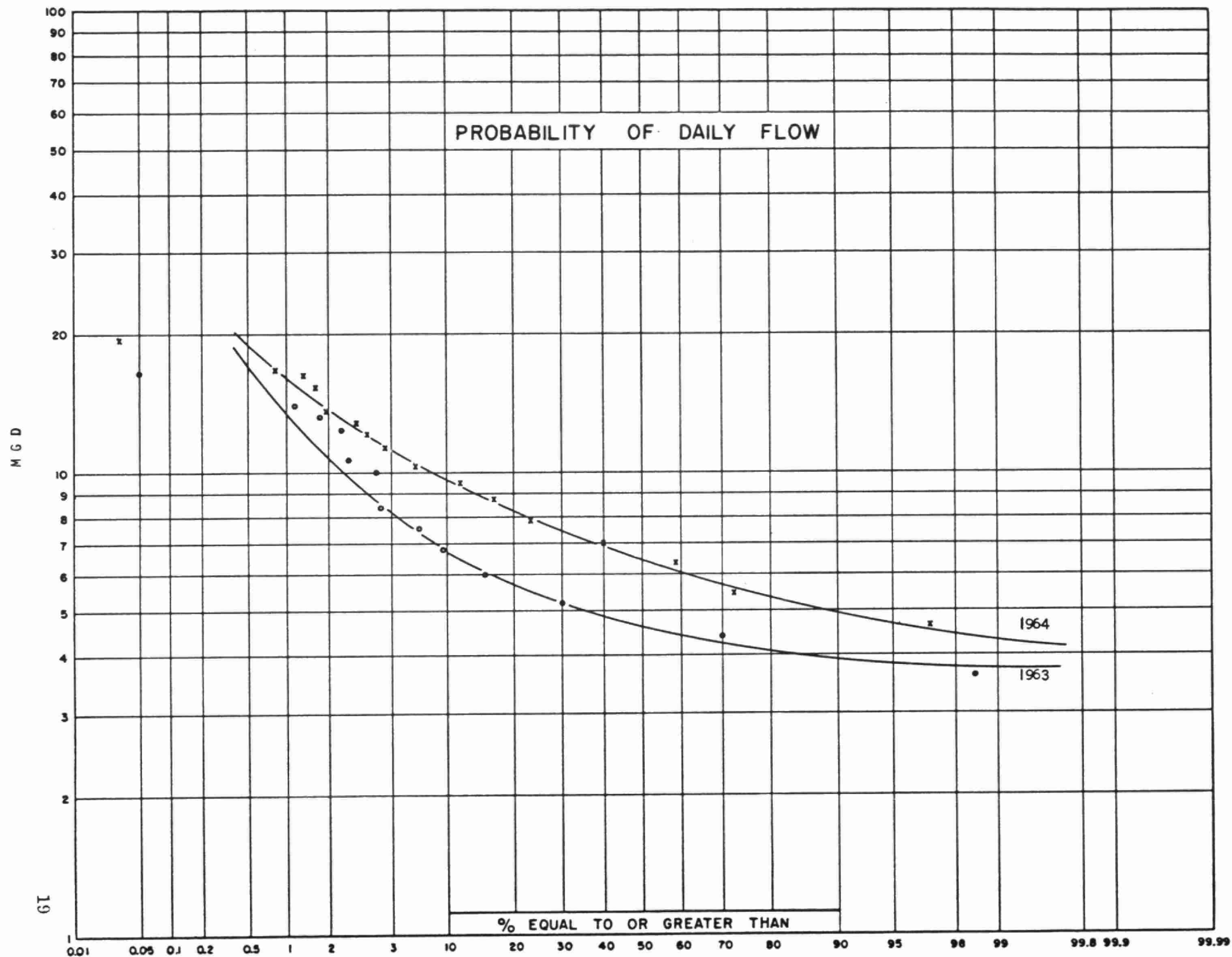
Two Komline-Sanderson diaphragm type ferric chloride pumps rated at 20 GPM and each powered by a 1/4 HP Reeves motor.

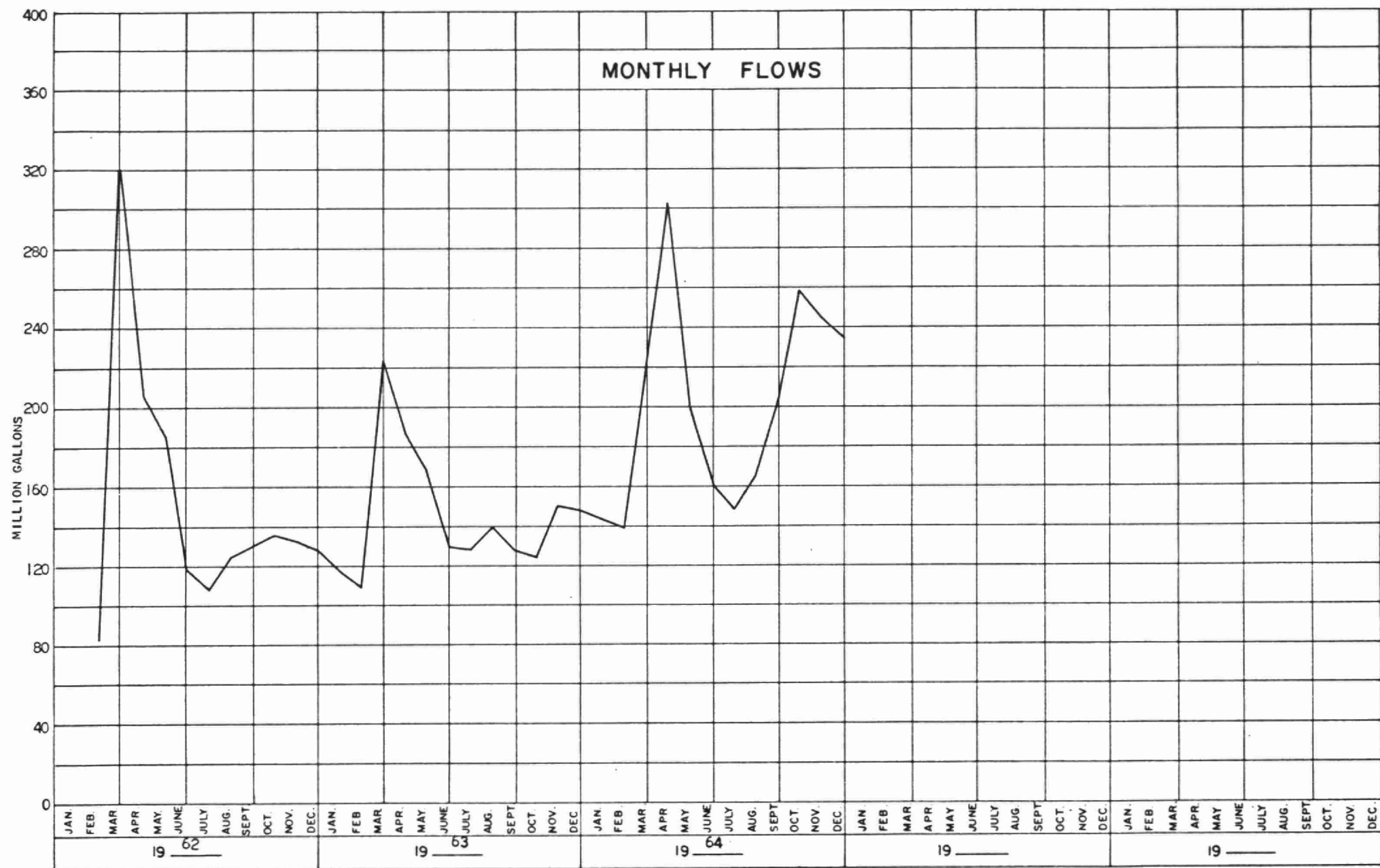
Two Aurora condensate pumps rated at 75 GPM and each powered by a Bull-E. R. & F. Turner Ltd. 2 HP motor.

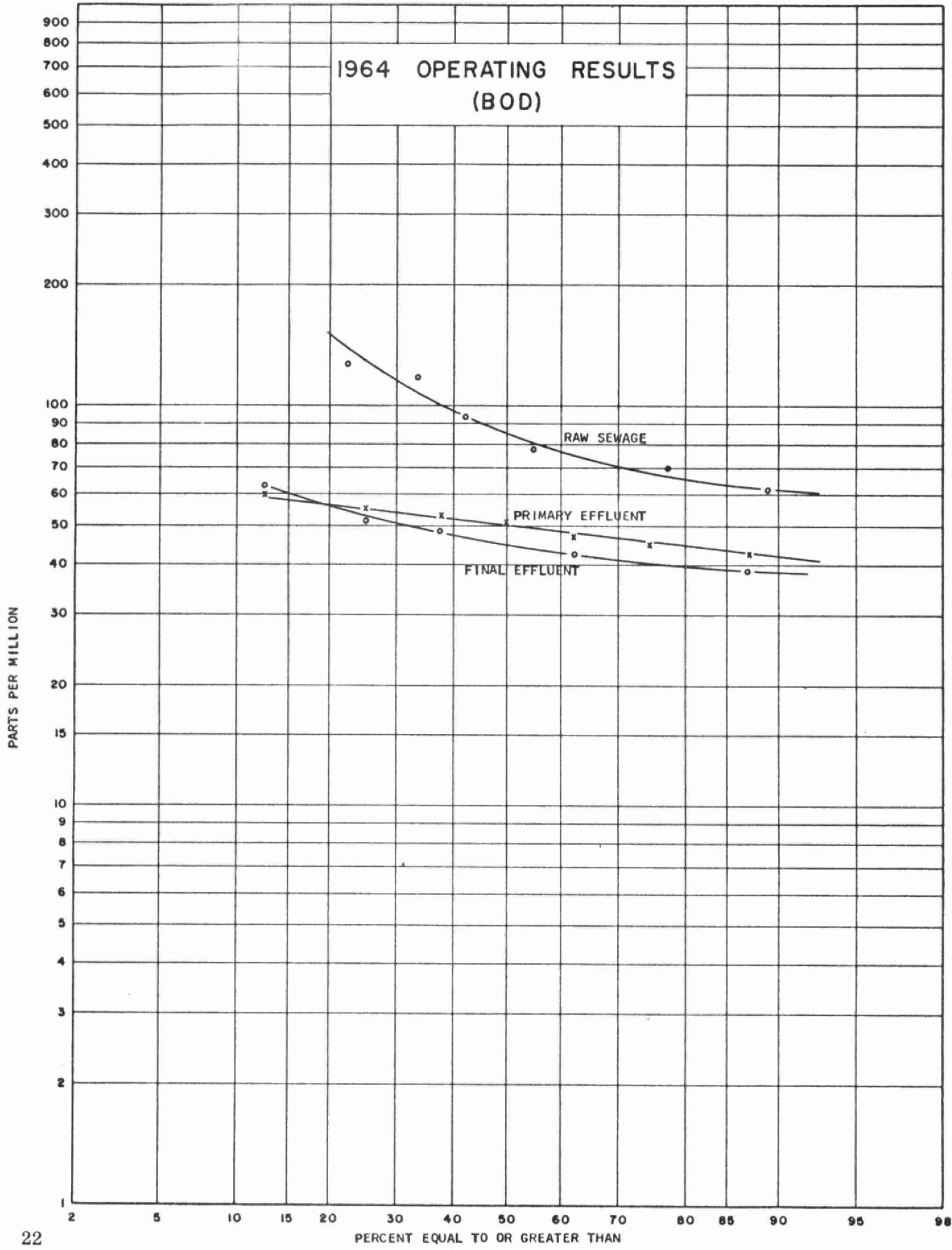
Two Nash Hytor vacuum pumps each powered by a 30 HP British Thomson-Houston Company motor.

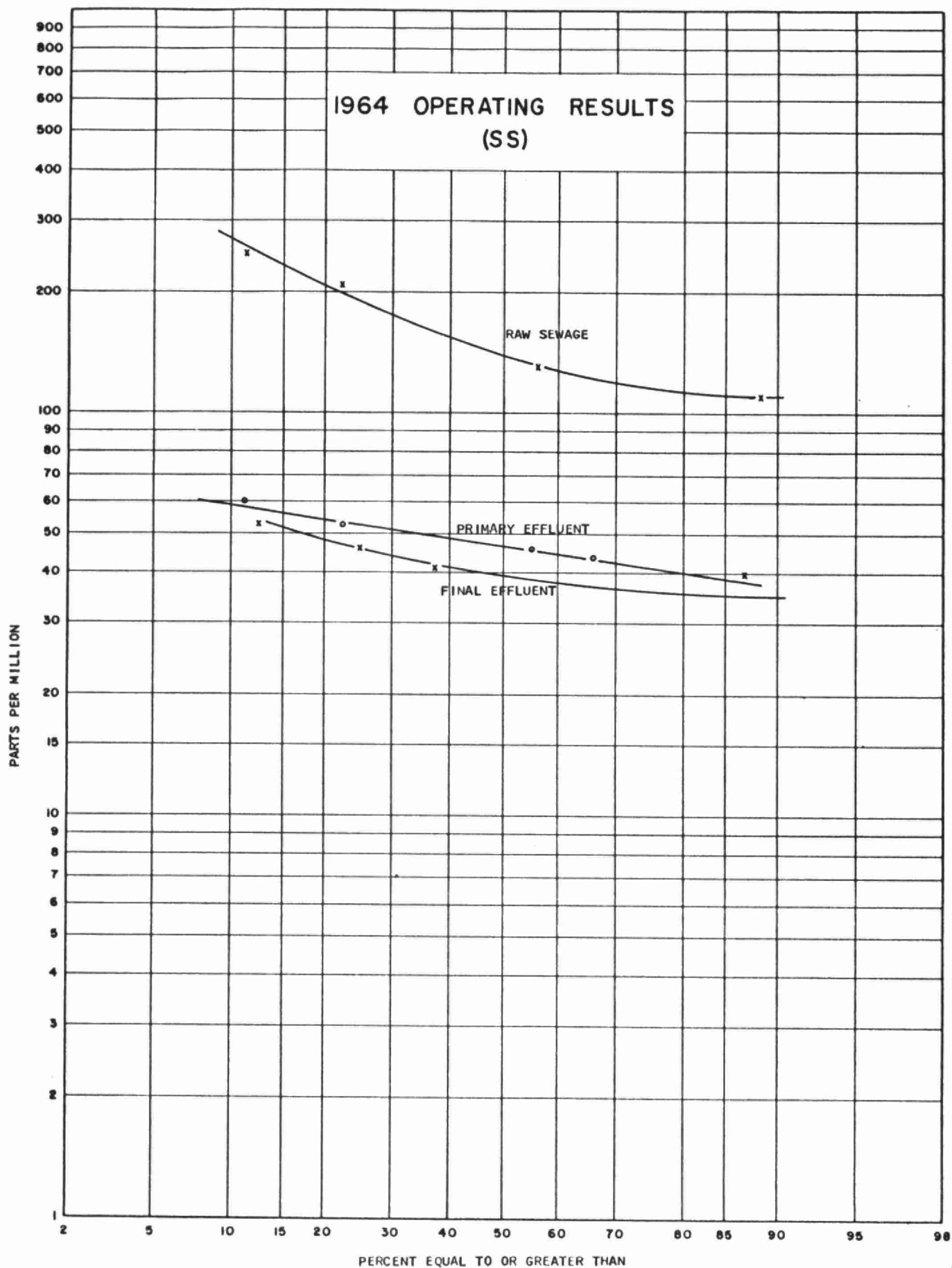
Two Dorr-Oliver-Long organic return pumps each powered by a 1/2 HPA Westinghouse motor.

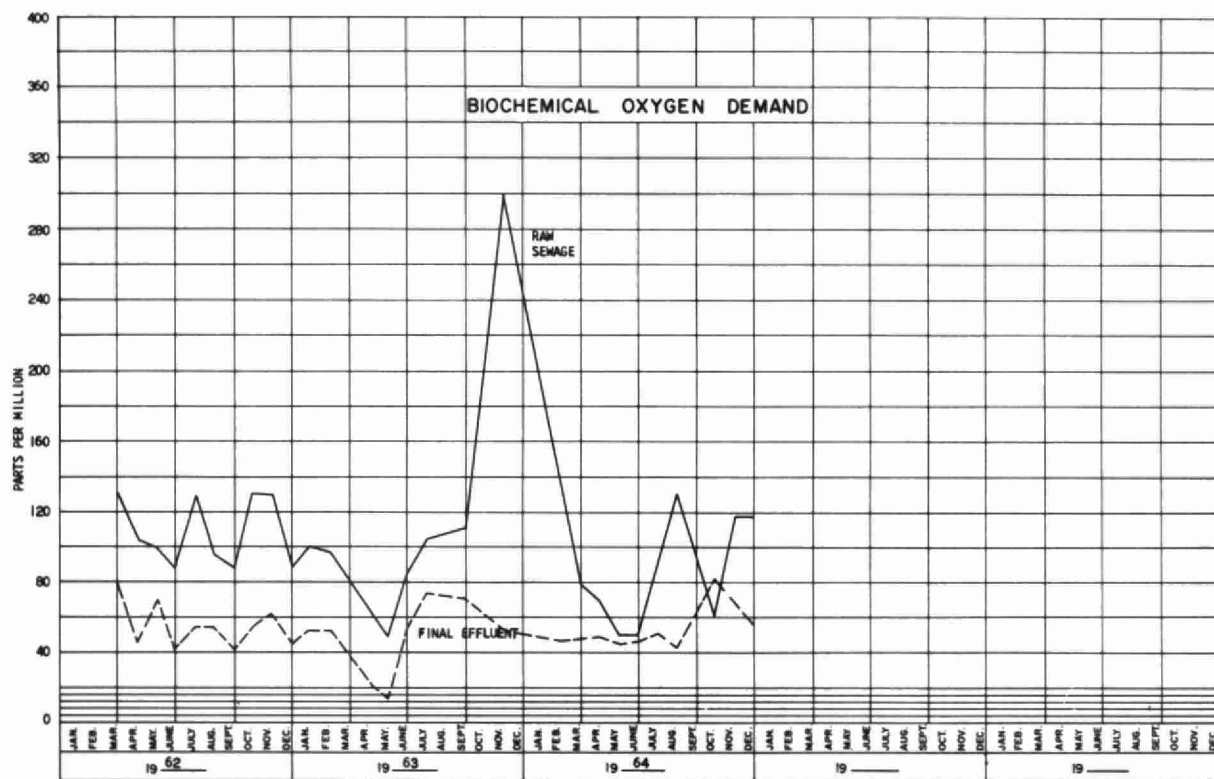
Two Smart-Turner sump pumps each powered by a 5 HP C. G. E. motor.



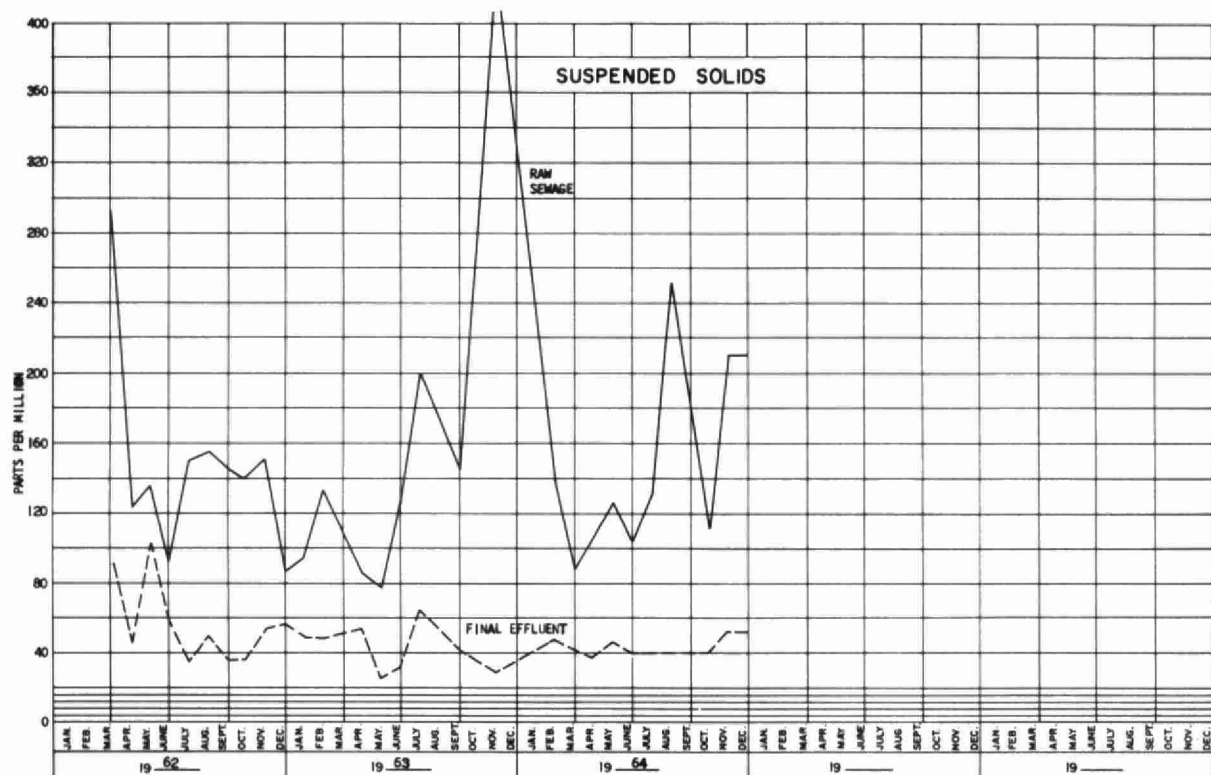








MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

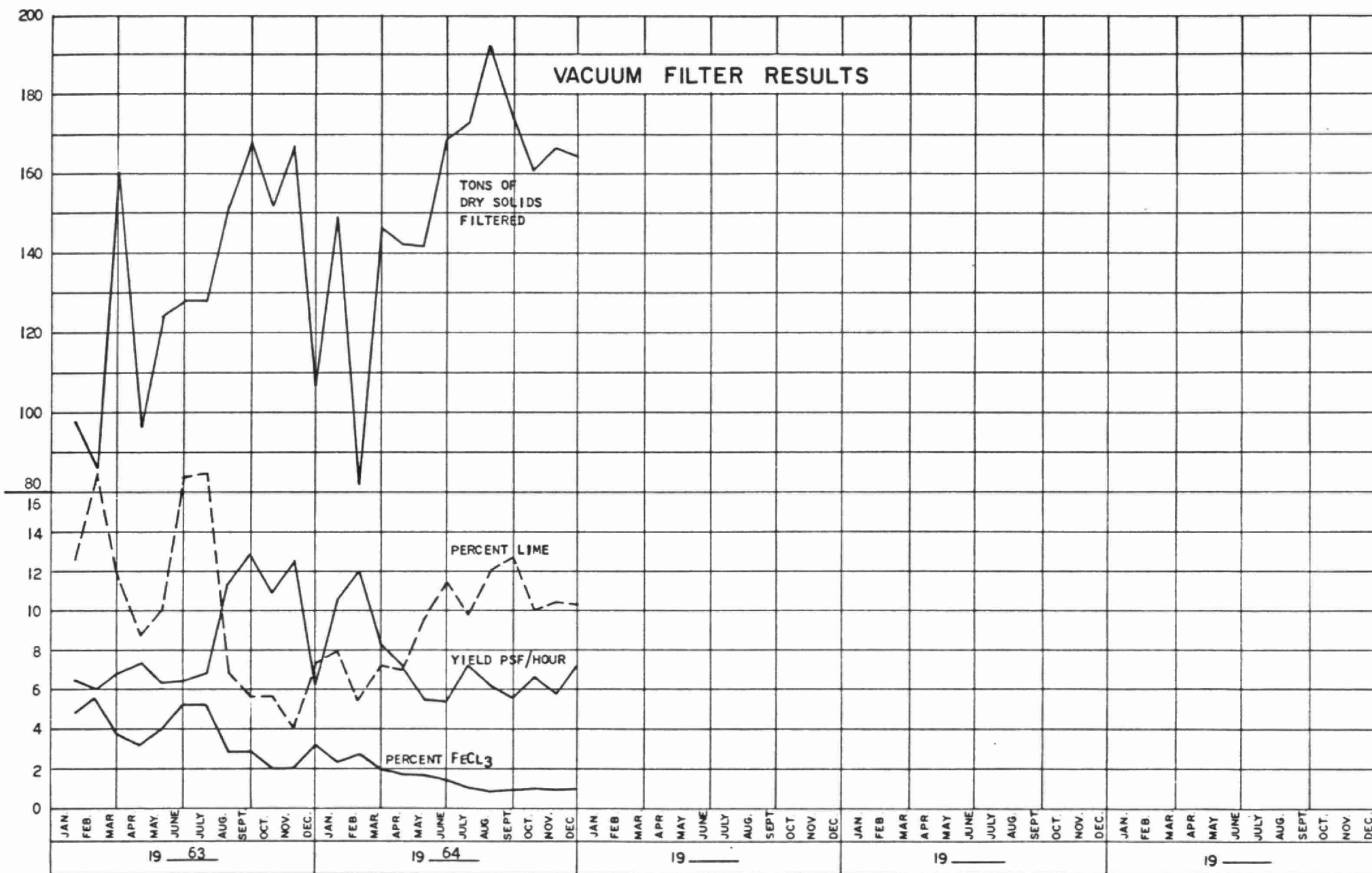
MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	
JAN.	* 95	47	50.5	34.3	144	43	70.0	72.2	314
FEB.	125	45	64	55.9	136	47	65.5	62.2	127
MAR.	77	49	36.5	30.4	87	38	56.5	53.3	317
APR.	* 95	47	50.5	72.7	144	43	70.0	153.1	415
MAY	72	45	37.5	27	126	46	63.5	80.1	183
JUNE	54	46	15	6.4	102	40	60.5	49.9	250
JULY	92	50	45.5	31.2	130	40	69.0	66.8	178
AUG.	130	42	67.5	72.6	252	40	84.0	174.8	442
SEPT.	* 95	47	50.5	48.6	144	43	70.0	102.3	695
OCT.	* 95	47	50.5	62.2	110	41	62.5	89.3	538
NOV.	118	55	53.5	77.2	210	53	74.5	192.5	663
DEC.	* 95	47	50.5	56.6	144	43	70.0	119.0	309
TOTAL	-	-	-	583.8	-	-	-	1228.5	4431
AVG.	95	47	50.5	48.6	144	43	70.0	102.4	369

* average values substituted. No sample.

COMMENTS

During 1964, the incoming sewage contained an average of 95 ppm BOD and 144 ppm suspended solids. The suspended solids content is consistent with average domestic sewage characteristics while the BOD is below average.

The removal of BOD and suspended solids content was 50.5% and 70.0% respectively and is considered very good for a primary treatment plant.



VACUUM FILTER OPERATION

MONTH	FILTER HOURS		% SOLIDS DIGEST SLUDGE	LBS. DRY SOLIDS FILTERED	LBS. LIME	% LIME	LBS. FeCl ₃	% FeCl ₃	% SOLIDS FILTERED SLUDGE	YIELD PSF/HOUR
	#1	#2								
JAN.	154.0	5.8	4.65	297640	34000	10.5	7581	2.40	23.7	7.95
FEB.	81.0	81.0	3.20	169838	20350	12.0	4700	2.76	22.6	5.35
MAR.	105.0	104.0	4.50	292757	23750	8.2	5847	2.00	23.6	7.10
APR.	103.0	103.0	4.40	285372	19800	7.0	5022	1.76	23.6	6.96
MAY.	75.0	75.0	6.50	284285	15650	5.5	4639	1.64	26.8	9.60
JUNE	77.0	77.0	7.30	336705	18300	5.4	4706	1.40	27.2	11.40
JULY	90.5	87.5	6.80	346982	25000	7.2	4163	1.20	25.8	9.65
AUG.	78.5	78.5	8.80	384753	24250	6.3	3175	0.82	26.0	12.00
SEPT.	70.5	70.5	7.02	350361	19400	5.6	2813	0.80	27.0	12.60
OCT.	81.0	79.0	7.20	320895	20950	6.5	2925	0.91	26.2	10.00
NOV.	79.0	79.0	7.20	332653	19200	5.8	2786	0.84	26.0	10.30
DEC.	83.0	83.0	6.70	328086	23550	7.2	2838	0.86	23.7	10.20
TOTAL	1077.5	923.3	-	3730327	264200	-	51195	-	-	-
AVG.	89.8	76.9	6.19	310861	22017	7.1	4266	1.37	25.2	9.43

COMMENTS

In 1964, the average solids content of the raw sludge was 6.19% as compared with 5.2% in 1963. A filtered sludge containing 25.2% solids was obtained using an average of 7.1% lime and 1.37% FeCl₃ as compared to 1963 when an average 10.1% lime and 3.6% FeCl₂ gave a filtered sludge containing 24.4% solids. The average yield of 9.43 pounds per square foot of filter area per hour of operating as compared to 8.2 pounds of solids in 1963 is indicative of the improvement in good filter operation.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	142.95	-	-
FEBRUARY	139.70	-	-
MARCH	217.46	-	-
APRIL	303.09	3295	2.92
MAY	200.32	8685	4.34
JUNE	160.88	7919	4.92
JULY	148.46	8610	5.80
AUGUST	164.90	9245	5.61
SEPTEMBER	202.57	10370	5.12
OCTOBER	258.96	5700	4.02
NOVEMBER	245.22	-	-
DECEMBER	235.69	-	-
TOTAL	2432.62	53824	-
AVERAGE	202.71	7689	4.76

COMMENTS

Chlorination, for purposes of disinfection, is carried on from spring break-up to fall freeze-up in the receiving stream. Chlorine application is effected by automatic proportioning equipment supplied from one ton cylinders.

Date Due

JUN 16 1967

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